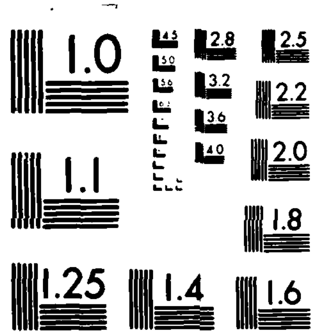
AD-A129 454   INDUSTRIAL PERFORMANCE OF POWERED BACK-UP ROLL FOR   1/1
PEELING VENEER(U) FOREST PRODUCTS LAB MADISON WI
S P LOEHNERTZ OCT 82 FSRP-FPL-430

UNCLASSIFIED   F/G 2/6   NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(12)

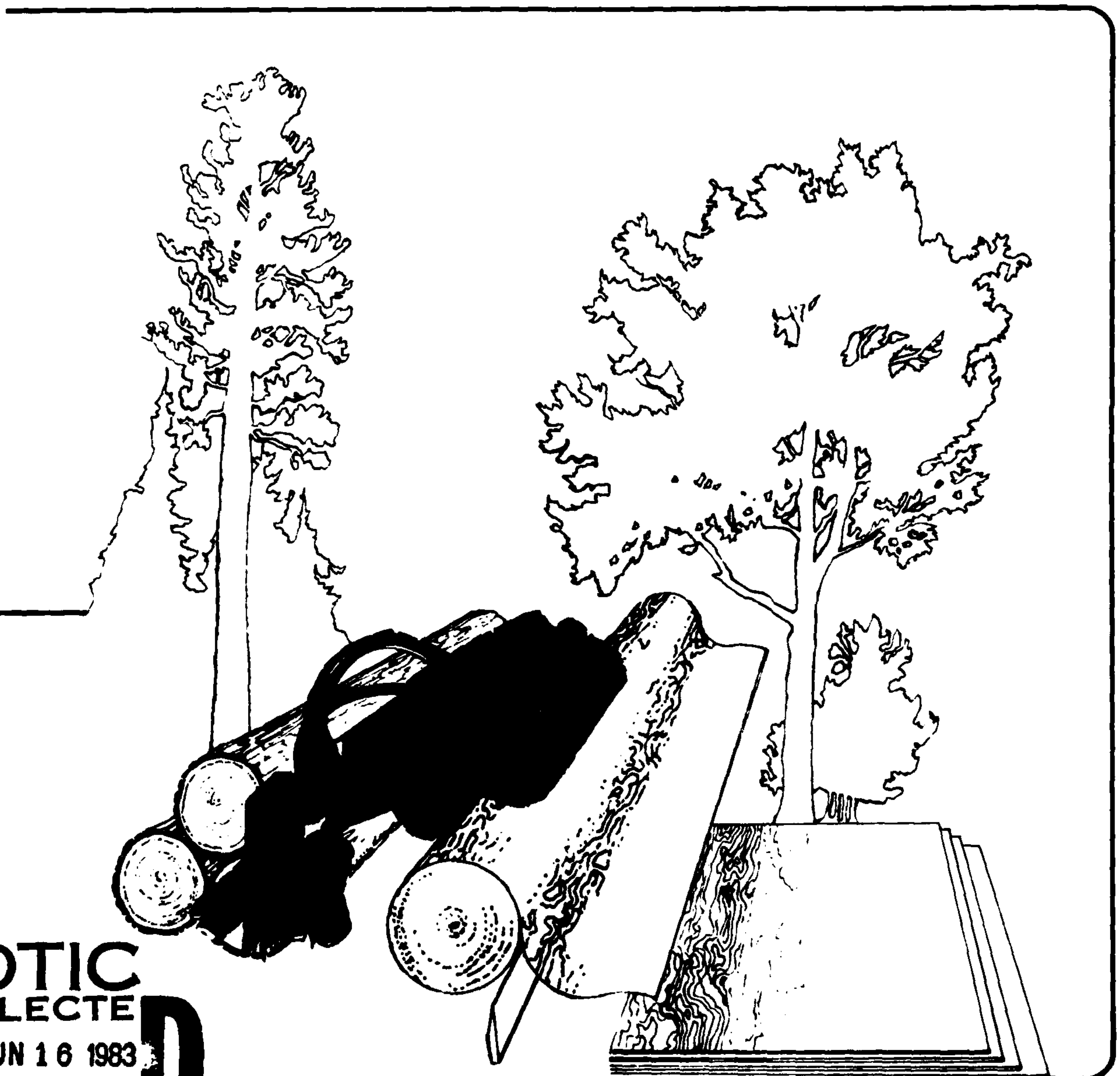
United States
Department of
Agriculture

Forest Service

Forest
Products
Laboratory

Research
Paper
FPL 430

Industrial Performance of Powered Back-up Roll for Peeling Veneer



Abstract

Veneer log spin-out has been a continuing problem in the plywood industry, contributing to increased timber consumption and higher costs. To alleviate this problem, a laboratory prototype powered back-up roll (PBR) was designed and built by the Forest Products Laboratory.

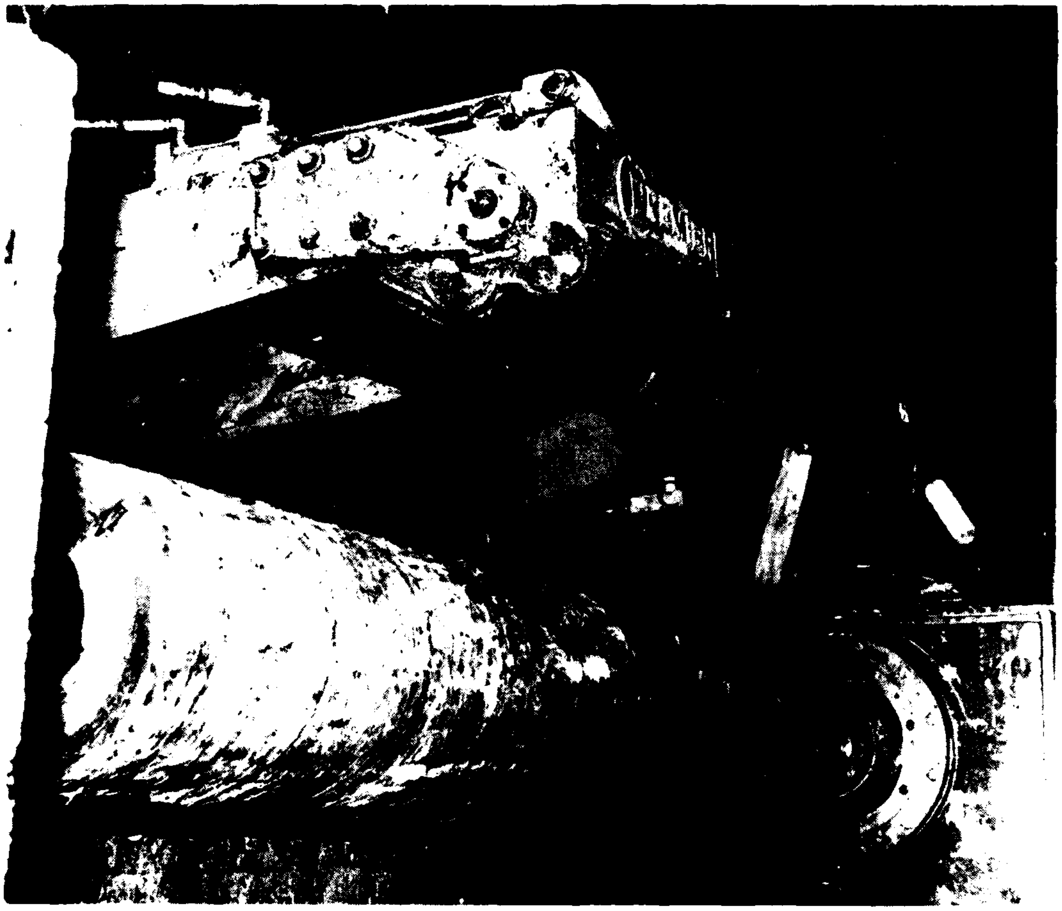
Because of satisfactory laboratory performance, a commercial model of the Forest Products Laboratory (FPL) PBR was installed in Boise Cascade's Yakima plywood plant. Operating under actual plant conditions, the PBR has significantly reduced spin-outs. It has not interfered with the normal veneer peeling operation, and has been well received by plant personnel. The payback period is estimated as less than 1 year.

This paper is the fourth in a series of four papers describing the FPL powered back-up roll. The other Research Papers are:

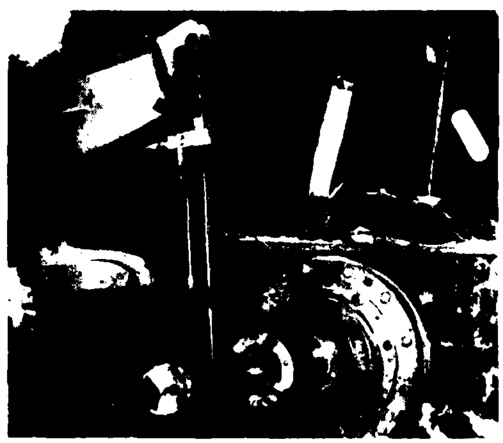
FPL 427 Influence of Chuck Design on Spin-Out Torque in Softwood Veneer Peeling Blocks
FPL 428 Powered Back-Up Roll—New Technology for Peeling Veneer
FPL 429 Laboratory Performance of a Powered Back-Up Roll for Peeling Veneer

Photo Supplement to Research Paper FPL-430

These photographs provide a ready reference on the Powered Back-up Roll (PBR) in commercial use. The PBR helps prevent or reduce veneer log spin-out by providing torque to the surface of the logs. These photos of the PBR at work were taken at Boise Cascade's Yakima, Wash., plywood plant, where this commercial model has been in operation since October 1981.

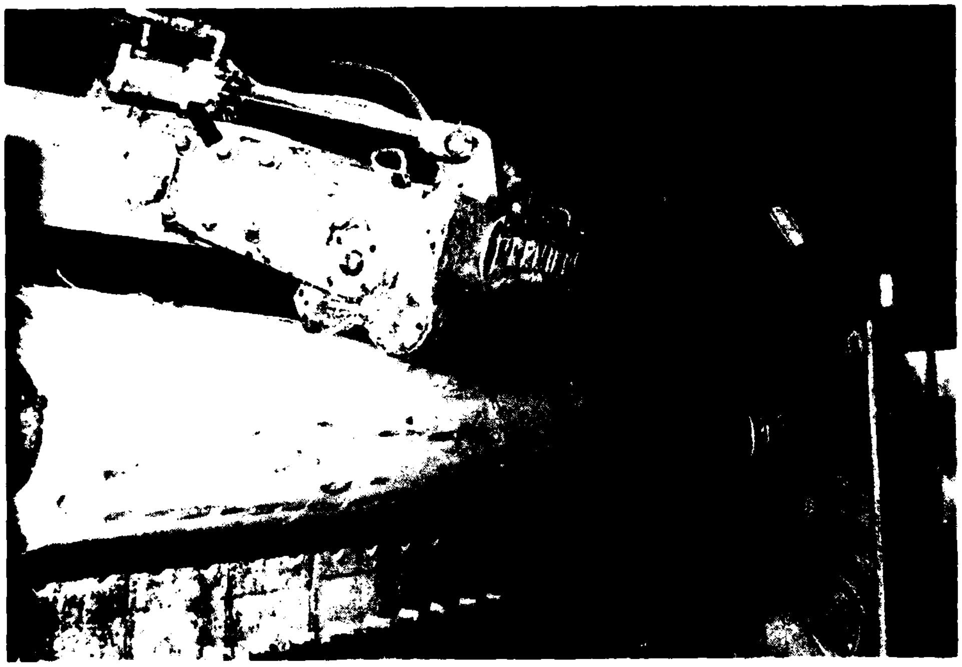


The powerhead assembly is ready to be lowered onto the log. Its two rollers assist the chucks in rotating the log against the lathe knife. The powerhead is mounted at the end of 4-foot long arms which extend outward from a rotating torque tube (A). At either end of the torque tube are lever arms (B) connecting the tube to hydraulic positioning cylinders (C). The cylinders raise and lower the powerhead and hold it against the log during peeling.

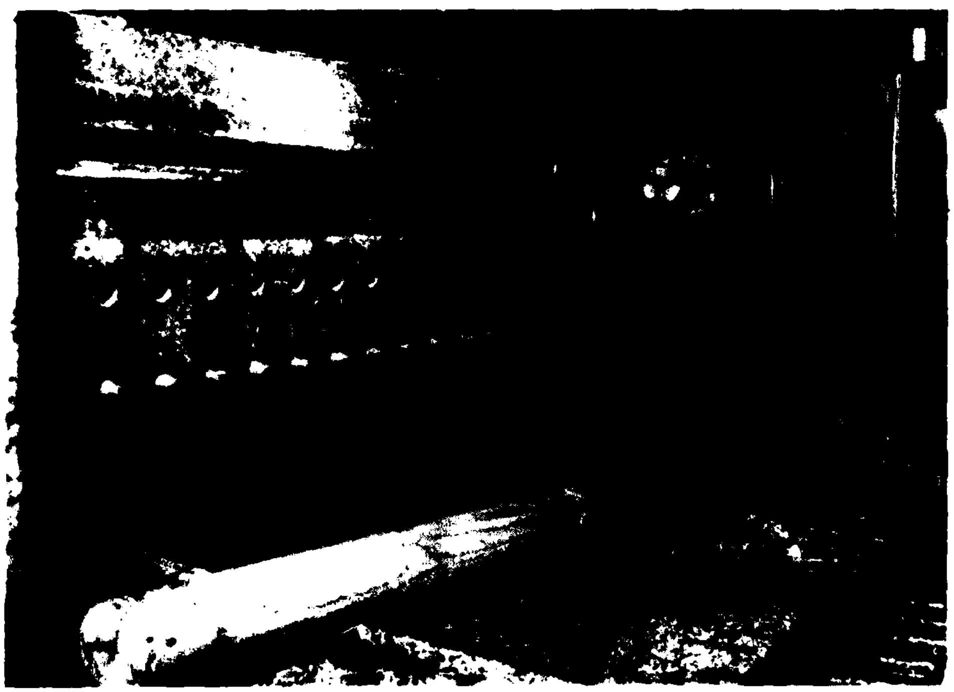


Closeup of a hydraulic positioning cylinder shows a position transducer (arrow), which helps control the position of the powerhead. Also shown are the dual lathe chucks, with outer chuck retracted.

Here the powerhead is in operation and the log is being peeled. The arrow points out a shock absorber on top of the powerhead that helps produce a smooth peel by dampening powerhead vibration.



When peeling is complete, the powerhead is lifted off the core, the spindles retract, and the core drops out.



Photographs courtesy of Boise Cascade
Published by the Forest Products Laboratory, Madison, Wis

United States
Department of
Agriculture

Forest Service

Forest
Products
Laboratory[1]

Research
Paper
FPL 430

October 1982

Industrial Performance of Powered Back-up Roll for Peeling Veneer

By
STEPHEN P. LOEHNERTZ, Research General Engineer

Introduction

Spin-out occurs when the lathe chucks spin freely in the ends of a veneer log. Some problems causing spin-out are in the log—punky wood in the center, or a hollow core. Another problem is overheating of the log ends, which softens the wood. The general problem is that more torque is required to turn the log than the chucks can provide resulting in spin-out. Once it occurs, a log cannot be peeled further for veneer.

The powered back-up roll (PBR) goes a long way towards solving this problem by providing torque to the surface of a log. This means that the chucks do not have to do all the work. It also means that smaller chucks can be used, resulting in a smaller core remaining. This all translates into additional veneer recovery, and savings of the timber resource.

The laboratory performance of a prototype PBR, designed by the Forest Products Laboratory (FPL), generated considerable industry interest. As a result, FPL entered into an agreement with Boise Cascade whereby a PBR was installed at their Yakima plywood plant (fig. 1). The intent was to reduce the spin-out rate with white fir logs. Table 1 lists the operating statistics for the Yakima plant.

The PBR installed at Yakima was designed and built by Premier Gear and Machine Works, and the controls system by Lloyd Controls. The PBR became operational in October 1981.

[1]Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

System Description

The major PBR components are the powerhead assembly, positioning assembly, hydraulic supply unit, and control system.

The powerhead assembly consists of two rollers, each 6 inches in diameter and 24 inches long, a 30-horsepower hydraulic motor, and a gear box (fig. 2). The powerhead is mounted on arms extending 4 feet outward from a torque tube mounted atop the lathe (fig. 3). The powerhead is raised and lowered by rotating the torque tube by means of a lever arm at each end to which a hydraulic cylinder is attached (figs. 4 and 5). One cylinder has a built-in transducer which indicates the position of the rollers at any time. Both the hydraulic motor and cylinders are serviced by a hydraulic power unit located off to one side of the lathe (fig. 6).

Controls

Two types of controls are built into the system. The first is the position control which holds the powerhead against the log with sufficient force to provide traction for the rollers. The position control circuit determines the radius of the log by monitoring the knife position, which indicates the location of the log surface. The control unit then commands the hydraulic cylinders to move the rollers to an imaginary point just inside the log surface, the so-called "interference" position. This creates a force between the rollers and the log. As the log is peeled this force is reduced in order to avoid pushing the smaller, more flexible core into the knife.

The second control matches the speed of the rollers to that of the log, and maximizes the torque transmitted

Figure 1.—Boise Cascade Yakima Plywood Plant.

(M 150 896-28)

Figure 2.—PBR powerhead assembly.

(M 150 896-17)

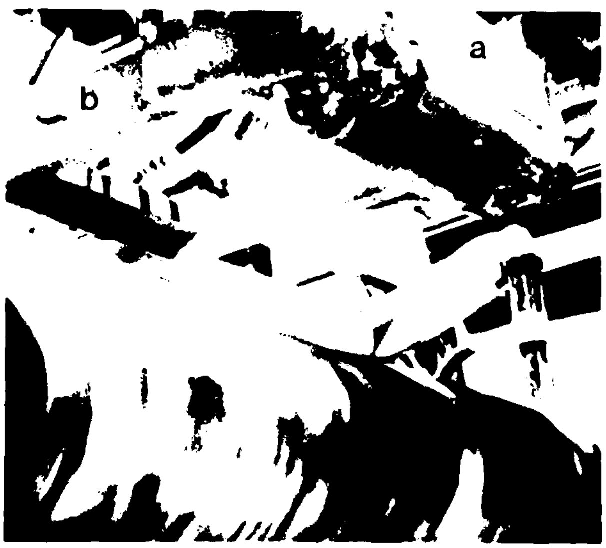


Figure 3.—View of powerhead (a) and mounting arms (b).

(M 150 896-20)

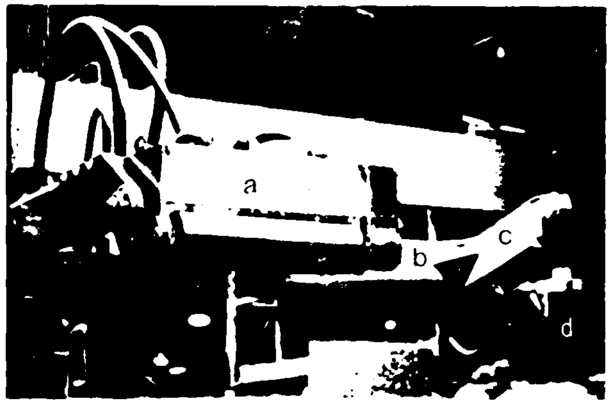


Figure 4.—View of powerhead (a) and one end of torque tube (b). Notice lever arm (c) and hydraulic positioning cylinder (d).

(M 150 896-26)

Table 1.—Boise Cascade Corporation Yakima Plywood Plant

Annual Capacity:	125 MMSF (3/8 in.)
Production:	75% CDX, 15% Underlayment, 10% Misc. Ext.
Logs:	Average Blocksize — 16 in.
	Species — Douglas-fir (50%), White fir (50%)
Block Conditioning:	Type — Hot Water
	Soak Time — 10 to 14 hours
	Temperature — 140° to 160° F
	Additives — Wetting Agent Used
Peel:	Douglas-fir — 1/8 in.
	White fir — 1/8 in, 3/16 in.

from the rollers to the log. The speed-matching circuit determines the surface speed of the log by combining the knife position (radius) signal with the spindle rpm signal. It also determines the roller surface speed from the roller rpm signal. The two speeds are compared and a difference indicates that the rollers are slipping. This causes an error signal to be generated which commands a servo-valve to adjust the flow to the hydraulic motor, causing the rollers to speed up or slow down as necessary. When the roller speed again matches the log speed, the roller torque is maximized as follows: The control unit monitors the knife position and from that determines log size and the acceptable roller torque. It then commands the servo-valve to adjust the hydraulic pressure to the motor as needed in order to achieve the correct torque.

Operation

The general sequence of events in the operation of the PBR is as follows: First, the log is rounded up the usual way without the PBR. Then, before the outer chucks retract, the PBR is lowered onto the log with the rollers already turning. The control system maintains correct position, speed and torque output. When peeling is complete, the powerhead is lifted off the core, the spindles retract, and the core drops out (fig. 7). The PBR in no way hinders normal operation of

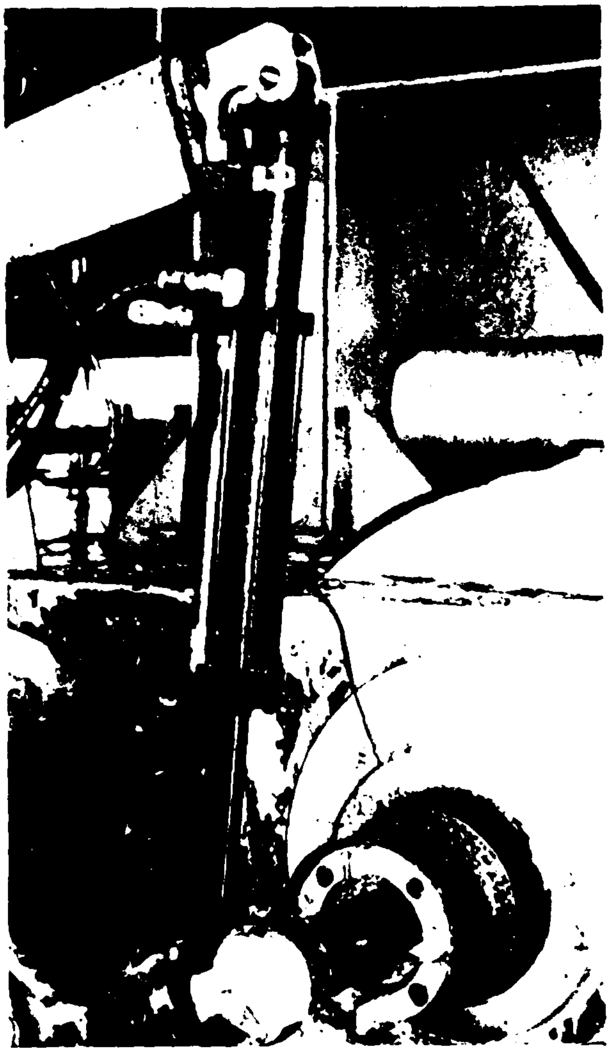


Figure 5.—Closeup of hydraulic positioning cylinder showing transducer location.

(M 150 896-33)

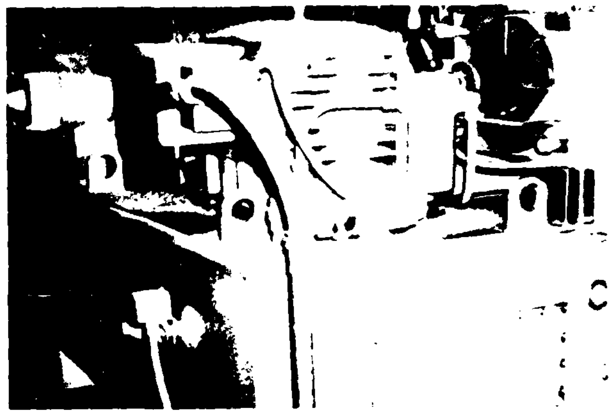


Figure 6.—Hydraulic power unit.

(M 150 896-22)

Figure 7.—Lift-off of powerhead (a), and core drop out (b).

(M 150 896-16)

the lathe. The operator still has a good view of the log as it is being peeled, due to the compact design of the PBR.

Installation and Startup

The PBR was installed in a Yakima plant in October 1981. It replaced the conventional nonpowered rollers on the 8-foot Premier lathe. The installation did not require modification to the lathe frame, and was accomplished over one weekend.

Several problems occurred with the initial startup but were quickly solved. First, there was a contaminant in the hydraulic oil which caused a servo-valve to fail. Second, one of the gears in the roller drive failed, and was replaced. Neither problem has reoccurred.

After 1 week of running, a roller shaft failed where the diameter was stepped down to form a shoulder for a bearing. The step created a stress concentration which led to the failure. A redesign eliminated this problem. After 7 weeks of running, part of the coating on one roller started to come off. It did not affect the operation of the unit, but shortly thereafter, both rollers were replaced. The new rollers have a different type of coating which is reinforced with a cord material, as in automotive tires. These rollers were still in service after 6 months, with no signs of trouble.

Test Program

A test program was jointly developed and conducted by personnel from the Forest Products Laboratory, Boise Cascade, and Lloyd Controls.

Yakima plant personnel documented the overall impact of the PBR on the peeling process, such as spin-out rate, veneer yield and core to stud yield. At this plant, spin-outs cannot be cut into studs because they are oversized for the stud mill.

Forest Products Laboratory personnel were on hand for 1 week of intensive data gathering to determine the system-operating characteristics. These included roller-torque output, control functions, roller-coating performance, and veneer quality. Data were recorded by means of a 3-channel Esterline-Angus chart recorder, and a Hewlett-Packard XY plotter. Similar determinations had been made in the Laboratory for the prototype.

Results-Yields

The PBR has proved very effective in reducing spin-out. This is noted in table 2 which shows the change in percent of logs which are peeled down to the core without spin-out. The biggest increase is for the white fir 3/16-inch peel. Improvements are also shown for Douglas-fir, and white fir 1/8-inch peel, although these are less prone to spin-out. Table 3 shows reduction in the spin-out volume as a percent of total block scale. Table 4 shows veneer and stud recovery increases that should be expected from the spin-out reduction that was achieved. These increases are 2 percent for veneer, and almost 11 percent for studs.

Table 2.—Percent change of logs peeled to core without spin-out

Species peel	Blocks to core size (5-3/8 in.)	
	W/O PBR	W/PBR
In.	Pct	
Douglas-fir 1/8	95.9	97.4
White fir 1/8	87.1	96.3
White fir 3/16	56.9	72.8

Table 3.—Reduction in spin-out as a percent of total block scale

Species peel	Spin-out volume as pct of total block scale	
	W/O PBR	W/PBR
In.	Pct	
Douglas-fir 1/8	0.4	0.1
White fir 1/8	1.8	0.3
White fir 3/16	7.1	2.7

Table 4.—Powered back-up roll effect on product recoveries

Product	W/O PBR	W/PBR	INCR(DECR)
			Pct
Veneer (msf/mbf)	2.50	2.55	2.0
Chips (bdu/mbf)	0.534	0.499	(6.6)
Studs (mbf/mbf logs)	0.090	0.099	10.9

Under normal market conditions the cost of the Yakima PBR could be paid off in less than a year.

Results-Operating Characteristics

The data describing the operation of the PBR are secondary in importance to the results just given, but they do provide useful design information.

Torque Output

It was not possible to directly measure the torque applied to the log by the PBR, so it was calculated from measurements of motor pressure and log diameter. The torque output of the hydraulic motor is proportional to pressure. The torque actually applied to the log is effectively multiplied through the PBR gear box, and again through the ratio of the log and roller diameters.

Representative torque curves are shown in figure 8. They are similar for both white fir and Douglas-fir. Comparing these data with results from the Laboratory, it is estimated that the values shown in figure 8 are approximately 25 percent of the total torque required to peel these species. The remainder of the torque must be provided by the chucks.

Controls

The normal force on the veneer log was calculated from the measured pressure in the hydraulic-positioning cylinders, taking into account the lever arm and adding on the dead weight of the roller head. The value of this force is approximately 1,400 pounds for a core diameter of 5-3/8 inches. The magnitude is somewhat higher at larger diameters.

Simultaneous recordings were made of roller and log speeds to determine if roller slip was occurring. None was detected. This means that either the control system is doing its job of preventing slip, or that the rollers have very good traction and are not likely to slip with the levels of torque and the normal force involved.

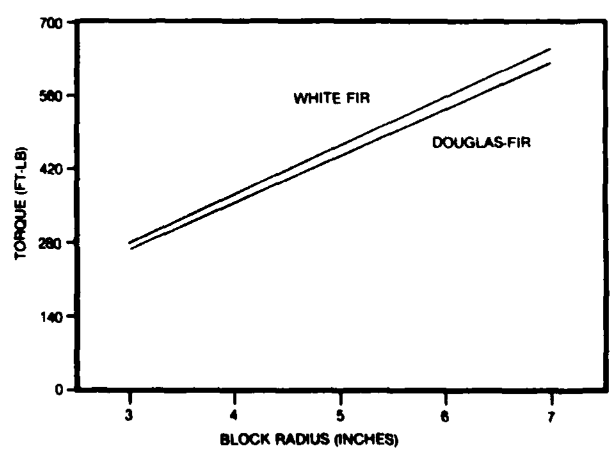


Figure 8.—Torque provided by PBR for peeling white fir and Douglas-fir.

Veneer Quality

Veneer quality was determined visually by inspecting the surface, and by measurement for uniformity of thickness. The veneer surface did not appear to have been affected by the powered rollers. There was no scuffing or marking, or any indication that the rollers had contacted the log.

The veneer thickness was fairly uniform, typically varying by no more than 0.006 inch across the width of an 8-foot sheet. Near the core, however, this variation increased to as much as 0.020 inch and the surface was considerably rougher. This is considered fairly typical for core veneer. Overall, it was judged that the PBR did not adversely affect veneer quality.

Roller Coating

The roller coating performed quite well during the test program. The rollers did not slip or mark the veneer, and stayed clean. Initially, there was concern that the coating would load up with pitch, but this did not happen. The rollers appeared to be self cleaning. As mentioned earlier, one of the roller coatings began to wear off after 7 weeks of operation, but a new material replacement is still in service. This is very encouraging, especially since little development effort went into evaluating different coating materials. Undoubtedly, preventing roller slip is a big factor in prolonging the life of the coating.

Discussion

The PBR program is a good example of technology transfer from the research laboratory to industry. It was made possible by cooperation between the Forest Products Laboratory, Boise Cascade, Lloyd Controls, and Premier Gear.

The PBR has proved itself in reducing spin-out, and increasing veneer and stud recovery at the Yakima plant. It has not interfered with the normal veneer peeling operation, and has been well received by plant personnel.

There are many refinements which undoubtedly can, and will be made to this basic design in the future as industry becomes more familiar with it. Boise Cascade feels it would pay for itself in less than a year in a normal market. Indications are that this new technology for peeling veneer will eventually be implemented industry wide.

U.S. Forest Products Laboratory

Industrial Performance of the Powered Back-up Roll, by Stephen P. Loehnertz, Madison, Wis., FPL 1982.

6 p. (USDA For. Serv. Research Paper FPL 430).

Describes the installation, startup, and testing program of the powered back-up roll for peeling veneer in operation at an industrial plywood plant.

Keywords: Powered back-up roll, veneer peeling, spin-out, veneer yield, veneer quality, resource recovery, chucks, core size, rollers, torque output.

3.0-6-12/82

ATE
LMED
-8.